What is claimed is:

1. A system for transmitting a digital signal, comprising:

an input means for receiving digital video data stream;

an encoding means for encoding robust data included in the digital video data stream such that the robust data are mapped to one of two groups {-5, -3, 1, 7} and {-7, -1, 3, 5} each having four levels, to thereby generate an encoded signal; and

a vestigial side band (VSB) transmitting means for performing VSB modulation of the encoded signal to generate a VSB modulated signal and transmitting the VSB modulated signal.

2. The system as recited in claim 1, wherein the digital video data stream includes normal data.

3. The system as recited in claim 2, wherein the encoding means encodes the normal data such that the normal data are mapped into {-7, -5, -3, -1, 1, 3, 5, 7}.

4. The system as recited in claim 1, wherein the encoding means includes:

a robust encoder for encoding two bits of information data (X_1', X_2') of the digital video signal to generate two bits of data symbol represented by (X_1, X_2); and

a trellis encoder for encoding the two bits of data symbol represented by (X_1, X_2) to generate three bits of data symbols each having one of three levels represented by (Z_2, Z_1, Z_0).

5. The system as recited in claim 4, wherein the robust encoder encodes the information data (X_1'') based on a prediction value of Z_0 such that the trellis encoder generates a data symbol having one of four levels {-5, -3,

1, 7} expressed in Table as:

X_1'	Z_0*	X_1	Z_2	Z_1	Z_0	Symbol Level
0	0	1	0	1	0	−3
1	0	0	1	0	0	1
0	0	1	0	1	0	−3
1	0	0	1	0	0	1
0	1	0	0	0	1	−5
1	1	1	1	1	1	7
0	1	0	0	0	1	−5
1	1	1	1	1	1	7

wherein Z_0* is a prediction value of Z_0.

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6. The system as recited in claim 4, wherein the robust encoder encodes the information data(X_1') based on a prediction value of Z_0 such that the trellis encoder generates a data symbol having one of four levels {−7, −1,
10 3, 5} expressed in Table as:

X_1'	Z_0*	X_1	Z_2	Z_1	Z_0	Symbol Level
0	0	0	0	0	0	−7
1	0	1	1	1	0	5
0	0	0	0	0	0	−7
1	0	1	1	1	0	5

0	1	1	0	1	1	−1
1	1	0	1	0	1	3
0	1	1	0	1	1	−1
1	1	0	1	0	1	3

wherein Z_0^* is a prediction value of Z_0.

7. The system as recited in claim 2, wherein the input means includes a multiplexer for multiplexing the normal data and the robust data if the digital video data streams include the normal data and the robust data,
    wherein a location of the robust data is defined by an equation as:

$$RPI = 312/NRP$$
$$RPP = floor(RPI \times r)$$

    where NRP denotes the number of the robust data packets included in the data frame to be transmitted; RPI denotes a robust data packet interval; RPP is a robust data packet position; floor(*) denotes a decimal cut-out computation; and r is an integer ranging from 0 to the NRP.

8. The system as recited in claim 1, wherein the encoding means includes a determining unit for selecting one of two groups $\{-5, -3, 1, 7\}$ and $\{-7, -1, 3, 5\}$ as a group to which the robust data is mapped.

9. A system for transmitting a digital signal, comprising:
    an input means for receiving a digital video data stream;
    a first encoding means for encoding robust data

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included in the digital video stream wherein the robust data are mapped to one of two groups {-5, -3, 1, 7} and {-7, -1, 3, 5} each having four levels;

5   a second encoding means for encoding robust data such that the robust data are mapped to another group having four levels;

a selecting means for allowing one of the first encoding means and the second encoding mean to receive the robust data; and

10   a VSB transmitting means for performing VSB modulation of the encoded signal to generate a VSB modulated signal and transmitting the VSB modulated signal.

10. The system as recited in claim 9, wherein the
15 digital video data stream includes normal data.

11. The system as recited in claim 10, wherein one of the first encoding means and the second encoding means encodes the normal data such that the normal data are
20 mapped into {-7, -5, -3, -1, 1, 3, 5, 7}.

12. A system for transmitting/receiving a digital signal, comprising:

a transmitting apparatus for transmitting the digital
25 signal; and

a receiving apparatus for the digital signal,
wherein the transmitting apparatus includes:
an input means for receiving a digital video data stream;

30   an encoding means for encoding robust data included in the digital video data stream such that the robust data are mapped to one of two groups {-5, -3, 1, 7} and {-7, -1, 3, 5} each having four levels, to thereby generate an encoded signal; and

35   a VSB transmitting means for performing VSB modulation of the encoded signal to generate a VSB modulated signal and transmitting the VSB modulated signal,

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wherein the receiving apparatus includes:

a receiver for receiving and converting the VSB modulated signal into a baseband signal;

an equalizer for deciding a level of the robust data
5 based on the group which is used for encoding the robust data in the transmitting apparatus, to thereby generate an equalized signal; and

a trellis decoding means for performing trellis decoding of the equalized signal based on the group which
10 is used for encoding the robust data in the transmitting apparatus, to thereby generate a trellis decoded signal; and

a decoding means for decoding the trellis decoded signal to restore the digital video data stream.
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13. The system as recited in claim 12, wherein the digital video data streams includes normal data.

14. The system as recited in claim 13, wherein the
20 encoding means encodes the normal data such that the normal data are mapped into $\{-7, -5, -3, -1, 1, 3, 5, 7\}$,

the equalizing means decides a level of the normal data based on $\{-7, -5, -3, -1, 1, 3, 5, 7\}$ to generated equalized normal data, and
25 the trellis decoding means performs trellis decoding of the equalized normal data based on $\{-7, -5, -3, -1, 1, 3, 5, 7\}$.

15. The system as recited in claim 12, wherein the
30 encoding means includes:

a robust encoder for encoding two bits of information data (X_1', X_2') of the digital video signal to generate two bits of data symbol represented by (X_1, X_2); and

a trellis encoder for encoding the two bits of data
35 symbol represented by (X_1, X_2) to generate three bits of data symbols each having one of three levels represented by (Z_2, Z_1, Z_0).

16. The system as recited in claim 15, wherein the robust encoder encodes the information data(X_1') based on a prediction value of Z_0 such that the trellis encoder generates a data symbol having one of four levels $\{-5, -3, 1, 7\}$ expressed in Table as:

X_1'	Z_0*	X_1	Z_2	Z_1	Z_0	Symbol Level
0	0	1	0	1	0	-3
1	0	0	1	0	0	1
0	0	1	0	1	0	-3
1	0	0	1	0	0	1
0	1	0	0	0	1	-5
1	1	1	1	1	1	7
0	1	0	0	0	1	-5
1	1	1	1	1	1	7

wherein Z_0* is a prediction value of Z_0.

17. The system as recited in claim 15, wherein the robust encoder encodes the information data(X_1') based on a prediction value of Z_0 such that the trellis encoder generates a data symbol having one of four levels $\{-7, -1, 3, 5\}$ expressed in Table as:

X_1'	Z_0*	X_1	Z_2	Z_1	Z_0	Symbol Level
0	0	0	0	0	0	-7
1	0	1	1	1	0	5

0	0	0	0	0	0	−7
1	0	1	1	1	0	5
0	1	1	0	1	1	−1
1	1	0	1	0	1	3
0	1	1	0	1	1	−1
1	1	0	1	0	1	3

wherein Z_0* is a prediction value of Z_0.

18. The system as recited in claim 13, wherein the
input means includes a multiplexer for multiplexing the
normal data and the robust data if the digital video data
streams include the normal data and the robust data,
    wherein a location of the robust data is defined by
an equation as:

    RPI = 312/NRP
    RPP=floor(RPI x r)

    where NRP denotes the number of the robust data
packet included in the data frame to be transmitted, RPI
denotes a robust data packet interval, RPP is a robust data
packet position, floor(*) denotes a decimal cut-out
computation, and r is an integer ranging from 0 to the NRP.

    19. The system as recited in claim 12, wherein the
encoding means includes a determining unit for selecting
one of two groups {−5, −3, 1, 7} and {−7, −1, 3, 5} as a
group to which the robust data are mapped.

    20. The system as recited in claim 12, wherein the
encoding means includes:

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a randomizer for randomizing digital video data stream to generate a randomized signal;

an RS encoder for performing Reed Solomon (RS) encoding of the randomized signal, to thereby generate an
5 RS encoded signal;

a robust interleaver/packet formatter for interleaving the robust data included in the RS encoded signal and formatting a robust data packet based on a coding rate of the robust data,; and

10 an interleaver for interleaving the robust data packet.

21. The system as recited in claim 20, wherein the decoding means includes:
15 a deinterleaver for deinterleaving the trellis decoded signal to generate a deinterleaver signal;

a packet formatter/robust interleaver for reformatting a robust data packet having information data based on the robust data included in the deinterleaver
20 signal;

an RS decoder for performing Reed Solomon (RS) decoding of the robust data packet to generate a RS decoded signal;

a derandomizer for derandomizing the RS decoded
25 signal to generate a derandomized signal; and

a demultiplexer for demultiplexing the derandomized signal.

22. The system as recited in claim 21, wherein the
30 receiving apparatus further includes:
a flag generator for generating a robust data flag indicating the robust data based on the restored robust data; and

delay buffer for buffering the robust data flag
35 during a delay time in the deinterleaver and transmitting the robust data flag to the packet formatter/robust deinterleaver.

23. The system as recited in claim 22, wherein the delay buffer delays the robust data flag during a delay time in the deinterleaver and transmits the robust data flag to the derandomizer.

24. The system as recited in claim 23, wherein, if the digital video data stream includes the normal data and the robust data, the receiving apparatus further includes:

a delay computing means for computing a delay time for the normal data based on the robust data flag received from the delay buffer and the restored robust data and transmitting the delay time for the normal data to the derandomizer.

25. A system for transmitting/receiving a digital signal, comprising:

a transmitting apparatus for transmitting the digital signal; and

a receiving apparatus for the digital signal,
wherein the transmitting apparatus includes:

an input means for receiving a digital video data stream;

a first encoding means for encoding robust data included in the digital video stream wherein the robust data are mapped to one of two groups {-5, -3, 1, 7} and {-7, -1, 3, 5} each having four levels;

a second encoding means for encoding robust data such that the robust data are mapped to another group having four levels;

a selecting means for allowing one of the first encoding means and the second encoding mean to receive the robust data;

a selecting means for allowing one of the first encoding means and the second encoding mean to receive the robust data; and

a VSB transmitting means for performing VSB modulation of the encoded signal to generate a VSB

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modulated signal and transmitting the VSB modulated signal,
wherein the receiving apparatus includes:

a receiver for receiving and converting the VSB
modulated signal into a baseband signal;

5   an equalizer for deciding a level of the robust data
based on the group which is used for encoding the robust
data in the transmitting apparatus, to thereby generate an
equalized signal; and

a trellis decoding means for performing trellis
10 decoding of the equalized signal based on the group which
is used for encoding the robust data in the transmitting
apparatus, to thereby generate a trellis decoded signal;
and

a decoding means for decoding the trellis decoded
15 signal to restore the digital video data stream.

26. The system as recited in claim 25, wherein the
digital video data stream includes normal data.

20   27. The system as recited in claim 26, wherein one of
the first encoding means and the second encoding means
encodes the normal data such that the normal data are
mapped into {-7, -5, -3, -1, 1, 3, 5, 7},

the selecting means allows one of the first encoding
25 means and the second encoding means to receive the normal
data,

the equalizing means decides a level of the normal
data based on {-7, -5, -3, -1, 1, 3, 5, 7} to generated
equalized normal data, and

30   the trellis decoding means performs trellis decoding
of the equalized normal data based on {-7, -5, -3, -1, 1, 3,
5, 7}.

28. The system for receiving a digital signal,
35 comprising:

a receiver for receiving and converting a VSB
modulated signal into a baseband signal;

an equalizer for deciding a level of the robust data mapped to one of two groups {-5, -3, 1, 7} and {-7, -1, 3, 5}, based on the group which is used for encoding the robust data in a transmitting apparatus, to thereby

5　generate an equalized signal; and

a trellis decoding means for performing trellis decoding of the equalized signal based on the group which is used for encoding the robust data in the transmitting apparatus, to thereby generate a trellis decoded signal;

10　and

a decoding means for decoding the trellis decoded signal to restore the digital video data stream.

29. The system as recited in claim 28, wherein the

15　digital video data streams includes normal data.

30. The system as recited in claim 29, wherein the equalizing means decides a level of the normal data based on {-7, -5, -3, -1, 1, 3, 5, 7} which is used for encoding

20　the robust data in a transmitting apparatus, and

wherein the trellis decoding means performs trellis decoding of the normal data in the equalized signal based on {-7, -5, -3, -1, 1, 3, 5, 7} which is used for encoding the robust data in a transmitting apparatus.

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31. The system for receiving a digital signal, comprising:

a receiver for receiving and converting a VSB modulated signal into a baseband signal;

30　an equalizer for deciding a level of the robust data mapped to groups including two groups {-5, -3, 1, 7} and {-7, -1, 3, 5}, each of which has four levels, based on the group which is used for encoding the robust data in a transmitting apparatus, to thereby generate an equalized

35　signal; and

a trellis decoding means for performing trellis decoding of the equalized signal based on the group which

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is used for encoding the robust data in the transmitting apparatus, to thereby generate a trellis decoded signal; and

a decoding means for decoding the trellis decoded
5   signal to restore the digital video data stream.

32. The system as recited in claim 31, wherein the digital video data stream includes normal data.

10   30. The system as recited in claim 29, wherein the equalizing means decides a level of the normal data based on {-7, -5, -3, -1, 1, 3, 5, 7} which is used for encoding the robust data in a transmitting apparatus, and

wherein the trellis decoding means performs trellis
15 decoding of the normal data in the equalized signal based on {-7, -5, -3, -1, 1, 3, 5, 7} which is used for encoding the robust data in a transmitting apparatus.

34. A method for transmitting a digital signal,
20 comprising the steps of:

a) receiving digital video data stream;

b) encoding robust data included in the digital video data stream such that the robust data are mapped to one of two groups {-5, -3, 1, 7} and {-7, -1, 3, 5} each having
25 four levels, to thereby generate an encoded signal; and

d) performing VSB modulation of the encoded signal to generate a VSB modulated signal and transmitting the VSB modulated signal.

30   35. The method as recited in claim 34, wherein the digital video data stream includes normal data.

36. The method as recited in claim 35, wherein the encoding means encodes the normal data such that the normal
35 data are mapped into {-7, -5, -3, -1, 1, 3, 5, 7}.

37. The method as recited in claim 34, wherein the

step b) includes the steps of:

b-1) encoding two bits of information data (X_1', X_2') of the digital video signal to generate two bits of data symbol represented by (X_1, X_2); and

b-2) encoding the two bits of data symbol represented by (X_1, X_2) to generate three bits of data symbols each having one of three levels represented by (Z_2, Z_1, Z_0).

38. The method as recited in claim 37, wherein the step of includes the step of encoding the information data(X_1') based on a prediction value of Z_0 such that the trellis encoder generates a data symbol having one of four levels {-5, -3, 1, 7} expressed in Table as:

X_1'	Z_0^*	X_1	Z_2	Z_1	Z_0	Symbol Level
0	0	1	0	1	0	-3
1	0	0	1	0	0	1
0	0	1	0	1	0	-3
1	0	0	1	0	0	1
0	1	0	0	0	1	-5
1	1	1	1	1	1	7
0	1	0	0	0	1	-5
1	1	1	1	1	1	7

wherein Z_0^* is a prediction value of Z_0.

39. The system as recited in claim 4, wherein the step of includes the step of encoding the information data(X_1') based on a prediction value of Z_0 such that the

trellis encoder generates a data symbol having one of four levels $\{-7, -1, 3, 5\}$ expressed in Table as:

$X_1{}'$	$Z_0{}^*$	X_1	Z_2	Z_1	Z_0	Symbol Level
0	0	0	0	0	0	-7
1	0	1	1	1	0	5
0	0	0	0	0	0	-7
1	0	1	1	1	0	5
0	1	1	0	1	1	-1
1	1	0	1	0	1	3
0	1	1	0	1	1	-1
1	1	0	1	0	1	3

5   wherein $Z_0{}^*$ is a prediction value of Z_0.

40. A method for transmitting/receiving a digital signal, comprising the steps of:

transmitting a digital signal; and

10   receiving the digital signal,

wherein the step of transmitting a digital signal includes the steps of:

a) receiving a digital video data stream;

b) encoding robust data included in the digital video

15 data stream such that the robust data are mapped to one of two groups $\{-5, -3, 1, 7\}$ and $\{-7, -1, 3, 5\}$ each having four levels, to thereby generate an encoded signal; and

c) performing VSB modulation of the encoded signal to generate a VSB modulated signal and transmitting the VSB

20 modulated signal,

wherein the step of receiving a digital signal includes the steps of:

d) receiving and converting the VSB modulated signal into a baseband signal;

e) deciding a level of the robust data based on the group which is used for encoding the robust data in the transmitting apparatus, to thereby generate an equalized signal; and

f) performing trellis decoding of the equalized signal based on the group which is used for encoding the robust data in the transmitting apparatus, to thereby generate a trellis decoded signal; and

g) decoding the trellis decoded signal to restore the digital video data stream.

41. The method as recited in claim 41, wherein the digital video data stream includes normal data.

42. The method as recited in claim 41, wherein the step b) includes the step of encoding the normal data such that the normal data are mapped into {-7, -5, -3, -1, 1, 3, 5, 7},

the step e) includes the step of deciding a level of the normal data based on {-7, -5, -3, -1, 1, 3, 5, 7} to generated equalized normal data, and

the step f) includes the step of performing trellis decoding of the equalized normal data based on {-7, -5, -3, -1, 1, 3, 5, 7}.

43. A method for receiving a digital signal, comprising the steps of:

a) receiving and converting a VSB modulated signal into a baseband signal;

b) deciding a level of the robust data mapped to one of two groups {-5, -3, 1, 7} and {-7, -1, 3, 5}, based on the group which is used for encoding the robust data in a transmitting apparatus, to thereby generate an equalized

signal; and

c) performing trellis decoding of the equalized
signal based on the group which is used for encoding the
robust data in the transmitting apparatus, to thereby
5   generate a trellis decoded signal; and

d) decoding the trellis decoded signal to restore the
digital video data stream.

44. The method as recited in claim 43, wherein the
10 digital video data stream includes normal data.

45. The method as recited in claim 44, wherein the
step b) includes the step of deciding a level of the normal
data based on {-7, -5, -3, -1, 1, 3, 5, 7} to generated
15 equalized normal data, and

wherein the step c) includes the step of performing
trellis decoding of the equalized normal data based on {-7,
-5, -3, -1, 1, 3, 5, 7}.